National Aeronautics and Space Administration

The Dryden X-PRESS

Simplify, simplify

Streamlined adaptive system works; capabilities verified

By Jay Levine
X-Press Editor

A Dryden F/A-18 proved a simplified adaptive controller can compensate for simulated failures of flight control surfaces and keep the aircraft flyable until landing safely. The Model Reference Adaptive Control, or MRAC, project also showed the range of the aircraft's research capabilities during a December flight.

Mark Dickerson, deputy project manager for Dryden's aviation safety program, and Jim Lee, project chief engineer for the MRAC and F/A-18 No. 853, recently talked about the success of the MRAC and the aircraft. It has been demonstrated through flight that the aircraft can be used to validate a number of new technologies that could lead to safer aircraft and a smoother ride and enable the aircraft to communicate when it needs maintenance.

The MRAC work takes what was started on the F-15 No. 837 prior to that test bed's retirement and finished on the F/A-18 aircraft, also referred to as the Full Scale Advanced Systems Technology, or FAST aircraft. The current adaptive control is comprised of less complex systems and algorithms that could make for a smoother transition to commercial use in the future, when new technologies are fully validated and verified, Dickerson said.

ED10 0372-24 **NASA Photo by Carla Thomas**

NASA's F/A-18 No. 853 validated through flight in December that a streamlined adaptive system could help an aircraft that has sustained damage to its flight control surfaces remain flyable. It also proved the aircraft's capabilities for a number of potential flight research projects.

"We pulled out what wasn't absolutely needed," he added.

However, the aircraft has significant capability. For example, Lee explained that the FAST aircraft has a dual computer system – a quad-redundant research flight control system, or RFCS, and a dual-redundant airborne research test system, dubbed ARTS IV – that provides a robust system for testing new concepts. In addition, about 200 strain gages remain on the flight control surfaces from the Active Aeroelastic Wing research program, which tested the concept of using lighter weight wings and wing twist for enhanced aircraft roll control.

The ARTS IV computer, a fourth-generation system developed at Dryden in collaboration with the West Virginia High Technology Consortium, enables testing of advanced control and sensor concepts. These concepts could lead to vehicles that control the shape of a fuselage while an aircraft is traveling supersonically. This could allow lighter-weight structures to be built and reduce the overall weight of the aircraft. These advanced concepts could be used to maintain a desired shape, alter the shape for performance, minimize gust loads or alter loads and shift stresses, Lee explained. Also, that technology

See MRAC, page 8

NASA joins support effort

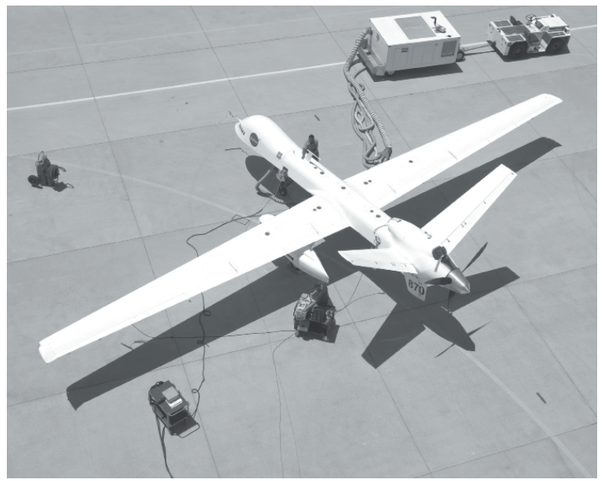
Ames, Dryden partner for 5-year CAL FIRE agreement

By Beth Hagenauer
Dryden Public Affairs and
Karen Jenvey
Ames Research Center

Ames Research Center, Moffett Field, Calif., has entered into a five-year Non-Reimbursable Space Act Agreement with the California Department of Forestry and Fire Protection, or CAL FIRE. The agreement provides a framework for using NASA technology and capabilities to support management and mitigation of wildfire disasters.

"The two entities have had an ad-hoc partnership for the last 25 years, and this agreement formalizes our working relationship and allows the two agencies to explore new technology developments and capabilities that support the needs of the people of California," said Vince Ambrosia, Ames principal investigator and senior scientist on the collaboration.

"CAL FIRE is proud to formalize its partnership with NASA," said Ken Pimlott, CAL FIRE director. "Under this agreement we will cooperatively explore the use and future transfer of advanced fire sensing technology. This, in turn, will benefit the public we serve by helping CAL FIRE increase situational awareness and response efficiency."



ED08 0151-07 **NASA Photo by Tony Landis**

Ground crews prepare the Ikhana for a mission.

Ames researchers developed a sensor called the NASA Autonomous Modular Scanner, or AMS, which operates in the visible, infrared and thermal spectrums and has been deployed on NASA's Ikhana Predator B unmanned aerial vehicle and on a manned B-200 King Air operated by Dryden. The scanner captures real-time wildfire imaging data over large-scale disaster events in the western United States, particularly California. AMS innovations include performance of all processing autonomously aboard the aircraft, and relaying data through a satellite communications system to disaster managers located anywhere in the world.

The system performed without error during several major wildfire events in Southern California in 2007 and during 2008 lightning-induced fires in Northern California. Those missions were flown aboard the Ikhana UAV. More recently, the team has focused on integration and operation of the sensor aboard the manned B-200 King Air aircraft.

"The B-200 has more rapid response capability than the unmanned aerial vehicles. The exciting element is that we have the ability to use different platforms as mission requirements change," Ambrosia said.

More on the AMS and the Western States Fire Missions is available at http://www.nasa.gov/centers/dryden/research/wsfm.html.

NSSC alters delivery of IT support and services

NASA is awarding new contracts that will change the way the agency provides Information Technology services and IT service support. These contracts fall under the umbrella of the IT Infrastructure Improvement Program, or I3P. Services range from support for desktop computers, phones and communications to Web services, data center services and enterprise applications.

The common structure to be shared by each set of IT services is the need for a self-help website (Tier-0 support) and an integrated service desk (Tier-1 support). The agency is investing in a software system that provides trouble-ticket and workflow-management capabilities and a service-ordering capability that will be managed by the Enterprise Service Desk at the NASA Shared Services Center.

The ESD responsibilities will include a 24/7-staffed customer-service help desk and a Web-based self-service interface. The ESD will provide the Tier-1 functions of triage and, if possible, first-call resolution. If unable to resolve a customer's issue, the ESD will initiate escalation to the appropriate Tier-2 service providers to be located at each center.

The ESD is additionally tasked with ensuring that the customer is kept up to date on actions for service requests that may extend beyond the Tier-1 or Tier-2 service expected-resolution times. The combination of shared services tenets and best-in-class IT Infrastructure Library processes will mean an effective IT service management infrastructure for collecting, analyzing and reporting on service-delivery performance.

A principle module of this system is the Enterprise Service Request System, which will encompass a new automated system for trouble-ticket and service requests. The ESRS will function as a "virtual shopping cart" for obtaining IT services. Customers across the agency will be able to select IT infrastructure services and then proceed to checkout.

Requests will be filled by I3P service providers. The service-request system will use as its basis for products the new Enterprise Service Catalog. The service-request capability will be available around the clock and will be accessible via a link on the NSSC customer service portal. The primary focus governing the system's design and implementation is support for the end user and providing a full set of IT services to be offered by Office of the Chief Information Officer service providers.

The ESD is scheduled to become operational in early 2011. The initial implementation of the ESD establishes a foundation that will support the gradual integration of NASA center IT-specific and non-IT institutional services.

ED10 0383-47 NASA Photo by Tony Landis

Chasing the Dragon

In need of a vehicle to chase the ER-2 as it lands, Dryden's ER-2 project obtained a lease on a government-owned 2010 Dodge Charger. The vehicle has law enforcement enhancements that enable it to reach speeds required for its mission: keeping an eye on the ER-2 aircraft as it lands, much as a chase aircraft is used to allow observation of research flights. The driver of the Charger, usually another ER-2 pilot, watches the aircraft's proximity to the ground and helps the pilot make a gentle landing. The ER-2 is a civilian variant of the military U-2 reconnaisance aircraft, which is also known as the Dragon Lady.

ED10 0383-67 NASA Photo by Tony Landis

NSSC News is quarterly

One of the most important tasks of the NASA Shared Services Center Customer Satisfaction and Communication Team is communicating with NSSC customers across the agency and ensuring that correct information reaches those who need it. To be successful, the transfer of information must be convenient and efficient because time is a valuable resource of every NASA employee.

The link below illustrates the team's latest effort to enhance communication with NSSC customers. The NSSC News will be a quarterly publication designed to provide succinct and informative updates on NSSC activities. In the interest of maximizing the tool's usefulness, team members are interested in hearing from any customer with ideas for desired content in future editions. The NSSC News may be found at https://searchpub.nssc.nasa.gov/servlet/sm.web.Fetch/Final_.pdf?rhid=1000&did=931764&type=released.

News at NASA

Fellowships to be offered

NASA is seeking applications from graduate students for the agency's new Space Technology Research Fellowships. Applications are being accepted from accredited U.S. universities on behalf of graduate students interested in performing space technology research beginning in the fall of 2011.

The fellowships will sponsor U.S. graduate student researchers who show significant potential to contribute to NASA's strategic space technology objectives through their studies. Sponsored by NASA's Office of the Chief Technologist, the fellowships' goal is to provide the nation with a pipeline of highly skilled engineers and technologists to improve America's technological competitiveness. NASA Space Technology Fellows will perform innovative space technology research today while building the skills necessary to become future technological leaders.

"Our Space Technology fellowships will help create the pool of highly skilled workers needed for NASA's and our nation's technological future, motivating many of the country's best young minds into educational programs and careers in science, technology, engineering and mathematics," said NASA Chief Technologist Bobby Braun.

The deadline for submitting fellowship proposals is Feb. 23. Information on the fellowships, including how to submit applications, is available at http://www.nasa.gov/offices/oct/early_stage_innovation/grants/NSTRF.html.

X-Press January 7, 2011

2010: A year of achievement

By Gray Creech
Dryden Public Affairs

Dryden continued supporting NASA's mission areas during 2010, advancing the agency's overall mission of leading the nation in aerospace technology and science research.

From supporting space shuttle missions and conducting a launch vehicle abort system flight test to preparing the next generation of aerospace workers, Dryden played a vital role in 2010 touching a number of NASA's efforts in service to the nation.

Science Mission Directorate

SOFIA – The Stratospheric Observatory for Infrared Astronomy, an international collaboration between NASA and the German Aerospace Center, achieved two major milestones in 2010. The team saw "first light" during initial in-flight night observations in May and completed the first three "early science" flights in December, demonstrating the SOFIA's potential to make discoveries about the infrared universe. Staged from the Dryden Aircraft Operations Facility in Palmdale, Calif., the initial astronomy mission focused on recording infrared imagery of areas within the Orion galaxy's star-formation complex with Cornell University's Faint Object InfraRed Camera for the SOFIA Telescope – known as FORCAST – instrument mounted on the telescope.

Operation IceBridge 2010 – The second year of study in NASA's airborne survey of Earth's polar ice, Operation IceBridge, kicked off in March when NASA aircraft arrived in Greenland. Operation IceBridge research allows scientists to track changes in the extent and thickness of polar ice, important for understanding of ice dynamics.

NASA's DC-8 airborne science laboratory played a central role in both the spring and fall IceBridge deployments. On 14 Arctic science missions during a five-week period, scientists and flight crew focused on Arctic sea ice, which reaches its maximum extent each year in March or early April. Greenland's ice sheet and outlet glaciers were surveyed on high- and low-altitude flights. The fall IceBridge Antarctic campaign, in mid-October and November, entailed 10 dedicated science flights with the DC-8 that totaled nearly 115 flight hours from a staging base in Punta Arenas, Chile, using a suite of seven environmental instruments. Researchers focused on re-surveying areas undergoing rapid change, using a suite of seven environmental instruments.

ED08 0056-28 NASA Photo by Tony Landis

The Boeing X-48 project continues to fly high. Research flights are expected to continue in 2011.

ED10 0182-4357 NASA Photo by Jim Ross

The Stratospheric Observatory for Infrared Astronomy reached a number of program milestones in 2010, including the first science missions.

Gulf for Oil Spill Surveys – NASA's Gulfstream III environmental research aircraft flew to the Gulf of Mexico June 22-24 for a radar-imaging mission over the Gulf oil spill, using the Uninhabited Aerial Vehicle Synthetic Aperture Radar, or UAVSAR, developed by the Jet Propulsion Laboratory. The flights, made at NOAA's request, followed up on previous imaging missions by NASA's ER-2 science aircraft with the AVIRIS spectrometer.

Quake Fault Studies in Haiti and the Dominican Republic – In response to the Jan. 12 disaster in Haiti NASA added a series of science overflights of earthquake faults in Haiti and the Dominican Republic, with the UAVSAR-equipped G-III, to a previously scheduled three-week airborne radar campaign to Central America.

GloPac Science Campaign – NASA successfully completed the first science campaign with the Global Hawk unmanned aircraft system from a control center at Dryden. The Global Hawk Pacific 2010 mission, or GloPac, involved a series of long-duration flights by the autonomously operated aircraft over the Pacific Ocean from the Arctic to the equator. Ten instruments on the aircraft collected a wide range of atmospheric data.

The timing of GloPac flights allowed scientists to observe the breakup of the polar vortex, a large-scale cyclone in the upper troposphere and lower stratosphere that dominates winter weather patterns around the Arctic and is particularly important for understanding ozone depletion in the Northern Hemisphere.

GRIP Mission – Dryden's DC-8 and Global Hawk aircraft were used in NASA's Genesis and Rapid Intensification Processes, or GRIP, mission in August and September. The six-week mission studied the formation and strengthening of tropical storms in the Gulf of Mexico and the western Atlantic Ocean.

Along with aircraft from Johnson Space Center and other agencies, more than 200 hours of data-collection flight time were flown, the DC-8 alone amassing more than 140 flight hours during 25 flights. The long-endurance, high-altitude Global Hawk flew several missions of more than 24 hours' duration during the campaign, including one flight of 20 passes over the eye of the developing Hurricane Earl.

Exploration Mission Directorate

Launch Abort System – NASA's Pad Abort 1 flight test, a launch of the abort system designed for a future crew vehicle, lifted off May 6 at the U.S. Army's White Sands Missile Range near Las Cruces, N.M. The 135-second flight was the first fully integrated test of this launch abort system design. Information gathered during the test will help refine design and analysis for future launch abort systems, resulting in safer and more reliable crew-escape capability during rocket launch emergencies.

Aeronautics Mission Directorate

X-48B blended wing body Phase 1 Test Flights – The NASA-Boeing X-48B team completed the first phase of flight tests on the subscale X-48B blended wing body aircraft at Dryden last March. Following completion of Phase I, the X-48B was disassembled for a complete inspection and refurbishment. Flying resumed with a checkout flight in September.

Phase I flight tests ascertained the handling and flying qualities of the blended wing concept at speeds typical of landings and takeoffs. Future flight tests will focus on additional parameter identification investigations following installation and checkout of a new flight computer. Parameter identification work will evaluate the new computer's control of the X-48B flight control surfaces and effect on the airplane's performance.

The remotely piloted, 500-pound airplane with a silhouette resembling a manta ray – also called a hybrid wing body – is a tool of NASA's new Environmentally Responsible Aviation, or ERA, project, which aims to develop the technologies needed to create quieter, cleaner and more fuel-efficient aircraft.

Supersonic Boundary Layer Transition Flights – Dryden flight-tested a subscale test article of an advanced laminar flow airfoil intended for Aerion Corp.'s planned supersonic business jet on Dryden's F-15B research aircraft. Called the Supersonic Boundary Layer Transition, or SBLT, project, the effort was accomplished through a Space Act Agreement between the two partners.

ED10 0309-11 NASA Photo by Tony Landis

NASA's DC-8, which is based at the Dryden Aircraft Operations Facility in Palmdale, had a busy year.

ED08 0230-357 NASA Photo by Tony Landis

Engineers and technicians watch as information is collected during moment-of-inertia testing of an abort flight-test module in the Dryden Loads Laboratory, part of Dryden's support of the project.

Sonic Boom Research – For several years, NASA has been researching means to reduce not only the strength of the shock wave produced when a high-performance aircraft exceeds the speed of sound, but also the perceived intensity of those shock waves – or sonic booms – heard by persons on the ground.

Dryden conducted several research flights with two F/A-18 aircraft in the Sonic Booms on Big Structures project in October to create multiple sonic booms of varying intensities in the local area of Edwards Air Force Base. Experiments examined the structural response of large office buildings to low-amplitude sonic booms and also allowed experienced observers to gauge the sonic booms' perceived intensity.

Boeing Phantom Ray arrives

By Gray Creech
Dryden Public Affairs

Dryden is hosting flight test operations of The Boeing Company's Phantom Ray, a stealthy, jet-powered Unmanned Aircraft System.

While at Dryden the Phantom Ray will undergo a series of tests to prepare it for use as a test bed for advanced technologies. Tests are expected to culminate in a first flight sometime in 2011.

Dryden is providing hangar facilities as well as engineering, ground test and test range support for the project.

Under a Boeing-funded commercial Space Act agreement with NASA, the Phantom Ray aircraft was ferried to Dryden from the company's facilities in St. Louis, atop NASA's Shuttle Carrier Aircraft 905. The Dec. 14 ferry flight marked the first time something other than a space shuttle was carried by one of the agency's two modified Boeing 747 SCAs.

The converted jumbo jetliner was the most efficient means of transporting the Phantom Ray. Its wings are not removable, making overland transportation difficult and costly. The UAS was mounted on a special Boeing-developed attachment rack installed on the 747's two aft space shuttle mounting pylons.

The Phantom Ray is based on the X-45C aircraft originally developed by Boeing for the Joint-Unmanned Combat Air System program jointly sponsored by the Defense Advanced Research Projects Agency, the U.S. Air Force and the U.S. Navy. That effort grew out of the X-45A project, in which two prototype technology-demonstration aircraft were successfully flown at Dryden between 2002 and 2005.

NASA Photo

The Boeing Company's Phantom Ray traveled from Boeing's facilities in St. Louis to Dryden mounted on the back of a NASA 747 Shuttle Carrier Aircraft. Boeing officials expect that a first flight with the unmanned aircraft system will be made at Dryden in 2011.

Dream Chaser makes first flight

By Gray Creech
Dryden Public Affairs

Dryden supported air-drop helicopter flight tests of a five-foot-long, 15-percent-scale model of the Sierra Nevada Corp.'s Dream Chaser spacecraft design under a Space Act Agreement between the two organizations.

The company's planned full-size Dream Chaser vehicle, based on the NASA HL-20 lifting body, is being designed to carry up to seven people to the International Space Station and back. The vehicle is slated to launch vertically on an Atlas V rocket and land horizontally on conventional runways.

Dryden provided ground and range safety support for the December drop tests, including a T-34 chase aircraft for photo and video imagery. The center also provided scheduling and flight test operations engineering support, along with hangar facilities and workspace.

The captive-carry and drop flights of the 88-pound model helped validate various aspects of the Dream Chaser vehicle's configuration and performance, such as flight stability and aerodynamic data for flight control surface deflections.

Sierra Nevada contracted with Northwest Helicopters of Tumwater, Wash., for the Bell 206B3 Jet Ranger helicopter that carried the Dream Chaser model on a 100-foot cable. The helicopter dropped the model from an altitude of 14,000 feet, with landing via parachute. The model was designed, built and operated as part of a joint effort between SNC and the Research and Engineering Center for Unmanned Vehicles at the University of Colorado at Boulder.

NASA selected SNC in February 2010 to begin development of commercial crew transportation system to and from low Earth orbit as part of NASA's Commercial Crew Development initiative and competition. It is part of an innovative effort by NASA to foster entrepreneurial activity leading to high-tech growth in engineering, analysis, design and research and to promote economic growth.

ED10 0373-43 **NASA Photo by Tony Landis**

The Dream Chaser makes a successful research flight after release from a helicopter.

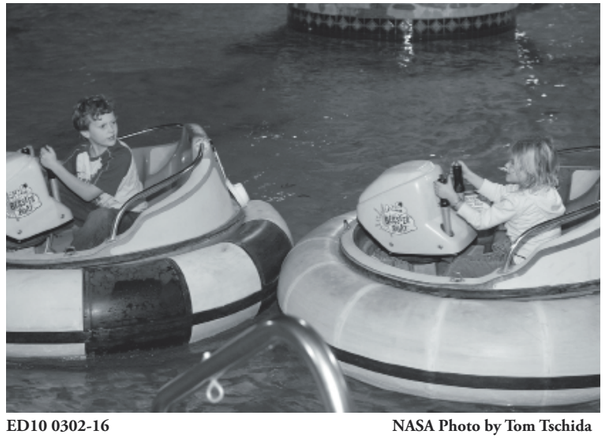
Holiday Happenings

ED10 0302-16 NASA Photo by Tom Tschida

***Above**, the Hallway Holiday Choir sang at Center Director David McBride's Open House Dec. 9. The open house also featured McBride's review of Dryden's 2010 achievements and refreshments for attendees.*

ED10 0302-16 NASA Photo by Tom Tschida

***Middle photo**, revelers had the holiday spirit at the Dryden Holiday Party, held Dec. 11 at the Embassy Suites in Palmdale.*



ED10 0302-16 NASA Photo by Tom Tschida

***At right**, nothing says the holidays like bumping into a friend with a bumper boat. At least that was true for youngsters at the Dryden Holiday Children's Party at Mulligan's Family Fun Center in Palmdale.*

Facilities inspections ensure safety

Facility inspections take place throughout the center for the purpose of ensuring the safety of workers and facilities. Inspections are scheduled by Oscar Perez, who contacts assigned building managers to coordinate the date and time for inspection. During an inspection, safety issues are identified and, if possible, corrected on the spot, e.g., replacing a knockout.

When a safety issue cannot be corrected on the spot, it is written up and noted by an EMCOR representative (who often accompanies inspectors) to be fixed. In addition, all previous write-ups are reviewed to ensure they are corrected and/or that they remain on the list of findings to be corrected. Those interested in the status of previous inspection write-ups should call Perez, ext. 5381, or Tara McCoy, ext. 7616.

-Passings-

Former Dryden employee Lannie Dean Webb, 74, died Dec. 26 of apparent heart failure. Webb was an engineer at Dryden for 36 years prior to his retirement in 1996.

Services were held Jan. 3 at Lancaster United Methodist Church. Interment will be in Smith Mountain Cemetery, Dinuba, Calif.

Jan. 29, 1963 – Walter "Whitey" Whiteside went to Long Beach and picked up a modified Pontiac Catalina to be used to tow the M2-F1 lifting body research vehicle.

MRAC... from page 1

could be used to reduce the signature of sonic booms.

Dickerson and Lee said the technology also is crosscutting because it could be used for lightweight structures intended for use in space. In addition, potential Dryden partners such as the Air Force Research Laboratory and a commercial aircraft company are looking at future technologies like MRAC that could offer significant improvements to next-generation aircraft and spacecraft.

The dual ARTS IV flight control computer allows up to eight experiments to be tested in a single flight, Lee said. Researchers believe the ARTS IV will be able to collect data from advanced sensors and send the information to the flight control system for adapting to conditions as they are happening, such as in gust alleviation, or fly-by-feel control. That is one possible experiment that could be researched thanks to the MRAC flight validation, he said.

The streamlined MRAC system will continue to evolve.

"This is a basic system without the features that add complexity. We are working to try to figure out if the bells and whistles are needed," Lee said.

In the meantime, the MRAC flight demonstrated aircraft capabilities that will allow for accelerated approval of a flight experiment, he added.

"ARTS enables researchers to propose a concept or experiment with NASA and get it to flight more quickly than [was] previously possible, and put the code and algorithms directly into the ARTS for verification and validation in a greatly reduced time frame. In addition, changes can be made to the experiment and those changes can be verified and validated and [made] ready to fly," Lee said.

ED10 008-12 **NASA Photo by Tony Landis**

Don Warren, right, writes a tag for the pallet removed from the bay of F/A-18 No. 853. Todd Shaw installs wiring in the aircraft.

Dickerson and Lee credited a talented and motivated team for completion of the milestone flight in the aviation safety program three to four months ahead of schedule. A combination of experience with similar, more complex systems, less complex code and anticipated funding deadlines at the end of the fiscal year allowed the team to reach the key flight, Dickerson said.

"We have quite a team. It took a lot of work – challenging work that was time-consuming and added pressure. However, our team kept focus," he said.

The MRAC work is a breakthrough that could have a big payoff. For example, there have been situations during the past two years in which commercial airliners carrying MRAC-type systems would have had an excellent chance of being saved or seeing a reduction in the number of injuries and fatalities, Dickerson said.

Such a system would allow an aircraft damaged by severe turbulence and loss of flight control surfaces to remain flyable with the damage. With the addition of a propulsion-controlled aircraft recovery, or PCAR, system also developed and validated at Dryden, even a case in which a horizontal tail was frozen in place might not have resulted in a crash, Dickerson said.

"There is strong potential that those aircraft could have been saved. There is the potential [through use of the new technology] to enable flying qualities that would allow a pilot to land," Dickerson said.

Within five years researchers hope to understand the system's full potential, he said. One idea researchers want to pursue is a ground collision-avoidance system such as that validated at Dryden during the Automatic Collision Avoidance Technology project, which could be used by a commercial airliner.

The concept of a system that predicts and characterizes structural failures also is high on the list. The addition of fiber optic shape sensors to the F/A-18 could collect and send information about what is happening to the wing as it occurs to the flight control computer, which could detect and mitigate failures before the situation becomes critical. That could ultimately limit or eliminate the need for structural inspections and reduce unnecessary down time for the aircraft, Dickerson said.

The F/A-18 is expected to continue to fly MRAC flights early this year. Regardless of what the F/A-18 will be used to research next, it now has the capability to prove concepts that will have a significant influence on future aircraft and spacecraft that could make them safer and improve their ride as well as advise maintenance staff when in need of attention.

The X-Press is published the first and third Fridays of each month for civil servants, contractors and retirees of the Dryden Flight Research Center.

Address: P.O. Box 273, Building 4839
Edwards, CA 93523-0273
Phone: 661-276-3449
FAX: 661-276-3566

Editor: Jay Levine, Tybrin, ext. 3459

Asst. Editor: Sarah Merlin, Tybrin, ext. 2128

Managing Editor: Steve Lighthill, NASA

Chief, Strategic Communications: John O'Shea

National Aeronautics and Space Administration

Dryden Flight Research Center
P.O. Box 273
Edwards, CA 93523-0273

Official Business
Penalty for Private Use, $300